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X-ray source population of the Galactic center region obtained with ASCA

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Abstract. From the *ASCA* X-ray point-source list in the Galactic center 5×5 degree^2 region, we found the clear correlation between the position of the sources and the absorption. This fact implies that the major part of the absorption is due to the cold interstellar matter (ISM) in the line of sight. Using the correlation, we estimate the distribution of the cold ISM. We also found that the ratio of high mass binaries to low mass binaries is significantly smaller than that in the whole Galaxy or SMC, which implies that the past starburst activity in the Galactic center region was rather quiet.

1. The *ASCA* Galactic Center Survey

Due to the crowdedness of and heavy absorption to the Galactic center (hereafter, GC) region, the information, including the distances, on the X-ray sources there has been limited. If the spectra of the sources are examined, the obtained column density can be a good indicator of the distance.

For the *ASCA* GC survey data, we have made point-source search, spectral fitting for the detected sources, and identification, combining past references (Sakano et al. 2001). We hence could determine their spectral parameters, including the column density, for the bright sources (Sakano et al. 2001).

We here investigate what determines the column density to bright X-ray sources, and then estimate the distribution of cold interstellar matter in the GC region. We study and discuss the statistical property of the X-ray sources in the GC region. We assume the distance to the GC to be 8.5 kpc.

Table 1. X-ray source population

	LMXB	HMXB	H/(H+L)†	mass	References
GC	23	4	15%	1	this work
Galaxy	79	34	30–40%	100	van Paradijs 1995
SMC	0	25 (+8)	100%	1	Yokogawa et al. 2000

†: ratio of HMXB number to the total source number.

2. Column Densities

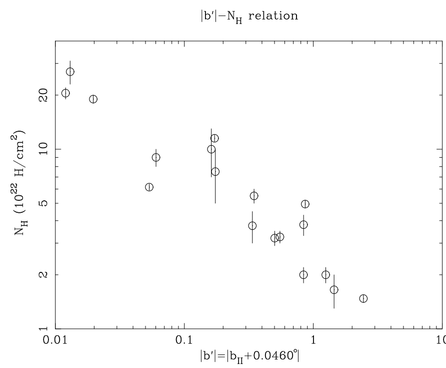

Figure 1. Source column density vs. angular distance from the plane (deg).

We found a good correlation of the column densities of bright sources to the absolute galactic latitudes (Fig. 1), whereas they are not constrained from the source category. These suggest that the large part of the source column densities are probably the cold ISM distributed along the plane and in the GC region. In addition, the little scatter implies that most of the sources are distributed in the special site, definitely near the GC. This relation reflects the cold ISM distribution in and in front of the GC region. From Fig. 1, we thus estimate the scale length of the cold ISM density in the GC region for the perpendicular direction from the plane to be 20 pc, whereas the total cold ISM mass is calculated to be 6×10^7 $M_\odot$, assuming the solar abundance and a simple radially-symmetrical shape for the cold ISM distribution.

3. X-ray source population

Our results strongly confirmed the population of late-type objects in the GC region (Table 1). Note that we classified pulsars to high-mass X-ray binaries (HMXBs) and bursters to low-mass X-ray binaries (LMXBs) because the companion stars are not identified for most of the sources. Since the companions of HMXBs are considered to have been born $\sim 10^7$ years ago, the number of HMXBs or the ratio of HMXBs to LMXBs is a good indicator for the past star formation activity in the observed region; our result suggests rather quiet star formation activity $\sim 10^7$ years ago in the GC region.

References

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